

comes patent that Hansen was a master of beautiful mathematical device. The bewildering detail ceases to obscure it when put into arithmetical form.

The problems of exact solution of the secular perturbations and of finding integrals of the equations of motion, which hold good for indefinite spans of time, must in the future occupy more and more attention.

Lately Hill has published an important memoir upon the subject (*Astronomical Journal*, vol. xxv.); two papers, Nos. 37 and 47, in the present volume show that his interest is not of recent date. No. 41, "Reply to Mr. Neison's Strictures on Delaunay's Method," shows him as a critic—a formidable though reserved antagonist not without ironic humour. No. 44, "On the Interior Constitution of the Earth as Regards Density," is a beautiful example of what he can do when working without the fetters of exact astronomy. Eventually the paper is a solution of the well-known equation for the density of a spherical aggregation of gravitating gas at constant temperature. The question had been treated before, but Hill's method is out of all measure more striking and complete than had been given previously.

NEOLITHIC MAN.

Neolithic Man in North-East Surrey. By Walter Johnson and William Wright. With a chapter on Flint by B. C. Polkinghorne. Cheaper re-issue. Pp. viii+200. (London: Elliot Stock, 1906.) Price 3s. 6d. net.

THIS book is the result of several years of archaeological investigation in the north-east corner of Surrey. The area visited measures about $14\frac{1}{2}$ miles by 13 miles; it would fall between the Thames on the north and a line drawn between Boxhill and Oxted on the south. Within these limits the researches of our authors have been patient and unwearying; they have sought for traces of Neolithic man in field after field, on height after height. Set down in their pages is a large amount of information as to his homes (Worms Heath, Croham Hurst, Barrow Hill, &c.) and burial-places; as to his methods of work, agricultural and domestic; as to the food he ate and the implements he used, celts, hammer-stones, arrow-heads, scrapers, &c. Some space too has been devoted to his track-ways and fortifications; in most cases the same ground was occupied at a later period by Roman roads and works, or those of other invaders less skilled in engineering.

The main subject is prefaced by an account of the various inhabitants who have succeeded one another in this country, especially the Neolithic and bronze-using peoples, and by a survey of the geological features of Neolithic Surrey. Our authors are certainly right in holding that the "ages" overlapped or merged into one another; the terms "Stone, Bronze, Iron age" are, in fact, merely conventional; they can only be applied to the phases in development during which stone, bronze, or iron began to be worked, side by side with the material already in use, not of necessity replacing it. In Lancashire,

for example, where the hills to the north prevented ready retreat in that direction, stone, bronze, and even iron seem to have been used contemporaneously at one period (see "Victoria County History of Lancashire"). Generally speaking, these opening chapters are highly instructive and accurate; they form a useful introduction to the story of Neolithic man. If they have a fault it is that they are perhaps a trifle too technical. Being a cheap re-issue, the present edition is obviously intended for the local student, to whom—not, of course, to the specialist—this preliminary information might be expected to be of service. In these circumstances the authors might have done better to leave out words like artifact, homotaxial, &c.; even geological terms like patina and Pleistocene, or at any rate to give their meaning. To leave them unexplained is to presuppose knowledge which is only too often to seek.

We have neither the space nor the necessary local knowledge to enter into a detailed criticism of the main subject. If we may venture a suggestion, we should recommend greater caution in the use of arguments based on etymology. We doubt very much whether all the authors' results (e.g. in chapter x.) would stand the scrutiny of a trained philologist. Only those who have made a special study of place-names are able to realise how dangerous and misleading this kind of evidence is apt to be.

There can be no question that the book is a valuable one. The extent of general knowledge displayed in it, and its high standard of scholarship, place its authors far above the ordinary run of local archaeologists. Their work is only popular in the sense that it is inexpensive. In addition to the maps and illustrations by Sidney Harrowing and Frank Percy Smith, it has an index and a list of the authorities referred to in each chapter. Mr. B. C. Polkinghorne contributes a supplementary chapter on the constitution and alterations of flint, with reference to the subject of flint implements.

OUR BOOK SHELF.

In the Days of the Comet By H. G. Wells. Pp. 395. (London: Macmillan and Co., Ltd., 1906.) Price 6s.

THOUGH the actual collision of the earth with the head of a comet is an extremely improbable event, it is not beyond the bounds of possibility. In 1861 the earth passed through the tail of a comet; and the showers of meteors occasionally observed near the end of November are probably due to encounters with fragmental remains of Biela's lost comet. The disc-like appearance of Holmes's comet in 1892 gave rise to the suggestion that the comet was approaching the earth head-on, and we believe Mr. Wells then used the idea in one of his clever short stories. In any case he would have no difficulty in finding justification for the supposed collision with a comet which forms the *deus ex machina* of the present romance.

The comet which springs from Mr. Wells's imaginative brain is seen in its early days by an enthusiastic amateur astronomer who forms one of the minor characters of the story as a "quivering little smudge of light among the pin-points," while the spectroscope showed "an unprecedented band in the green." The unknown element which this peculiar green radiation

represented proves to be the Divine afflatus that lifts the human race out of selfish individualism into socialism understood in its finest sense. The struggle for existence and the survival of the fittest no longer express operations of natural law, and the world becomes a place where the prevailing spirit is "all for all and each for each." Love is transfigured, hate perishes, war and all other manifestations of our animal nature are rendered unthinkable after the earth has passed through the comet. The change which evolution can scarcely anticipate in the distant future is brought about in a single night.

The idea is a noble one, and Mr. Wells has dealt with the phenomenal and sociological aspects of the transformation in a masterly manner. What is the destiny of the human race cannot yet be foreseen, but what man might become when "a new heaven and a new earth" have been created is a worthy subject of speculation; and when the theme is developed, as it is in this book, with scientific knowledge, prophetic insight, lofty purpose, and human sympathy, it almost persuades us that the gospel it conveys points the way to the millennium. The message may not be understood, but the story in which it is presented cannot fail to excite interest and stimulate thought.

The Elements of Chemical Engineering. By Dr. J. Grossmann, with a preface by Sir W. Ramsay, K.C.B., F.R.S. Pp. viii + 152. (London: C. Griffin and Co., Ltd., 1906.) Price 3s. 6d. net.

It can scarcely be said that our system of technical education is satisfactory, so far as chemical technology is concerned. Our technical colleges and universities turn out annually a large number of students who have received a fairly good training from the theoretical point of view, but have very little knowledge of apparatus or processes as conducted on the manufacturing scale. It is obviously impossible for teachers who have not themselves been engaged in factories to teach chemical technology successfully. Our German competitors have fully realised this, and some of the larger chemical manufacturers have combined and founded an institution specially devoted to the education of teachers, all the operations being carried out on the manufacturing scale. In the absence of some educational establishment of this kind we must assume that the education of most of our students is defective from the practical point of view, and means must be found to convey the requisite knowledge before they can be entrusted with the supervision of manufacturing operations.

Dr. Grossmann's book has been specially written with this end in view, the object of the author being to make the student familiar with those factory appliances which are the equivalents of the apparatus used in the laboratory. To render the comparison still more easy, the plant described is classified according to the supposed laboratory appliance which it represents. It is not always easy to ensure parallelism under such an arrangement; for instance, the chapter on "The Funnel and its Technical Equivalents" deals mainly with filtration, which is not the primary function of a funnel. The remarks on the materials used in chemical engineering are practical, and will be of great use to students, whose knowledge on this subject is usually very defective.

Among the useful features in which this work differs from similar manuals may be mentioned the price list of chemicals, which will be of great service to beginners, although, as Dr. Grossmann rightly remarks, the prices are liable to frequent fluctuations. How great these fluctuations may be is shown by the fact that copper is now twice and antimony three times the price quoted in the list. The price given for amyl acetate, 4l. 14s. 6d. per lb., is evidently an error.

As Sir William Ramsay says in his preface, the author has given a simple and lucid statement of the difficulties that a student may expect to meet with, and the book may be recommended as an introduction to the practical work of the factory.

Crystal Gazing. Its History and Practice, with a Discussion of the Evidence for Telepathic Scrying. By Northcote W. Thomas. With an introduction by Andrew Lang. Pp. xlvii + 162. (London: Moring, Limited, 1905.) Price 3s. 6d. net.

THE practice which gives its name to this book is only one of a number of devices which have been employed to assist the appearance of visual hallucinations. Mr. Thomas gives a popular account of the various methods which have been used in classical, mediæval, and modern times, and describes the practices of various savage or barbarous peoples, such as the use of blood by the Maories and Pawnees, of quartz by the people of Sarawak, and of mirrors by the members of more advanced races.

The subject has two distinct aspects. One deals with the nature of the psychological processes involved in the appearance of the visions, and, treated from this point of view, crystal gazing is brought into line with other psychological processes, such as visual imagination, hypnagogic and hypnotic illusions and hallucinations, &c.

The other aspect deals with the question whether the visions of the scryer provide any evidence in favour of telepathy. On this aspect Mr. Thomas gives accounts from many sources, and concludes that, though fragmentary and unsatisfactory, the evidence is, on the whole, in favour of telepathic crystal visions. It must be pointed out, however, that his data provide perhaps equally strong evidence in favour of prophetic scrying. The book has an introduction in which Mr. Andrew Lang gives an account of the circumstances which first led him to take an interest in crystal gazing and of many experiments with which he has had to do. Mr. Lang regards his own ventures in this field as those of an amateur, and he appeals to professed psychologists to undertake the further investigation of the subject. His own attitude, however, is so eminently judicial that it is a matter for regret he cannot himself give more attention to this line of work, for the judicial mind is not too common either in the more academical or the more amateur students of this field of research.

The History of the Collections contained in the Natural History Departments of the British Museum. Vol. ii., Separate Historical Accounts of the Several Collections included in the Department of Zoology. Pp. 782. (London: British Museum, 1906.) Price 30s.

In this volume officers of the various sections of the Zoological Department have given accounts of the collections under their respective charge, tracing the evolution of each from small beginnings to its present condition. Each account is complete in itself; but a remarkable degree of diversity is noticeable in regard to the amount of space occupied by the different histories, the notice of the bird collection far exceeding all the others in length. At the end of each account is a biographical list of the various donors and collectors who have contributed to the section. This involves a large amount of repetition, and some discrepancies are noticeable when the different lists are collated. In many portions of the volume the editorial blue pencil might have been used freely with great advantage, and in some places the prolixity is so great that it is exceedingly difficult to winnow out the grain from the chaff. Nevertheless, the volume contains a great mass of valuable information with regard to